

SERIES	I	I	II	II	II	III	III	III	III	IV
GROWTH TEMPERATURE	760°C	760°C	760°C	810°C	700°C	650°C	700°C	760°C	800°C	VARIABLE
PH ₃ PRESSURE	800 pa	800 pa	2600 pa	800 pa	2600 pa	2600 pa	2600 pa	800 pa	800 pa	VARIABLE
INDIUM COMPOSITION	0.27/	0.32/	0.33/	0.33/	0.33/	0.10/	0.10/	0.10/	0.10/	0.40/
(NOMINAL/MEASURED)	0.26	0.31	0.34	0.31	0.36	0.15	0.09	0.11	0.12	0.39
GRADING RATE	VARIABLE	VARIABLE	CONSTANT	CONSTANT	CONSTANT	CONSTANT	CONSTANT	CONSTANT	CONSTANT	CONSTANT

FIG. 1

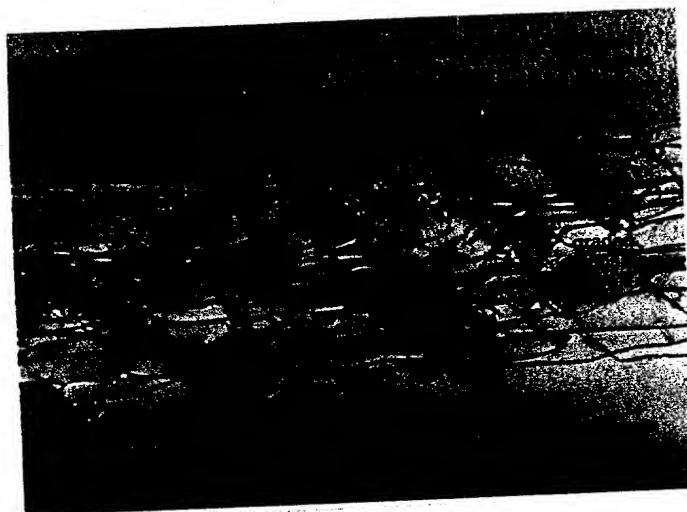


FIG. 2

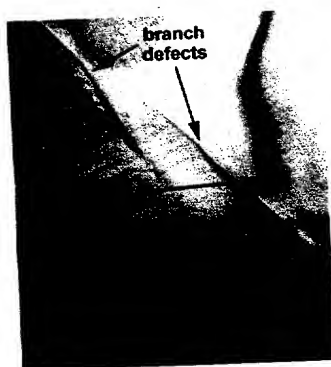


FIG. 4A



FIG. 4B

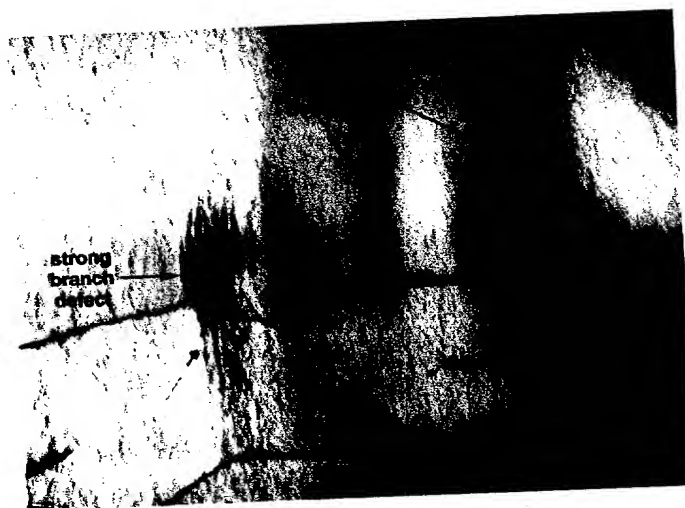


FIG. 5

204040 244000

TEMPERATURE	760°C	760°C
x	0.26	0.31
$R_q - (10\mu\text{m})^2$ scan area	$25\text{ nm} \pm 6\text{ nm}$	$45\text{ nm} \pm 25\text{ nm}$
$\beta_{(004)}$	$170' \pm 8'$	$303' \pm 10'$
$\rho_{\text{field}} - \text{PVTEM}$	$6.3 \times 10^6\text{ cm}^{-2}$ $\pm 2.4 \times 10^6\text{ cm}^{-2}$	$1.1 \times 10^8\text{ cm}^{-2}$ $\pm 0.2 \times 10^8\text{ cm}^{-2}$
$\rho_{\text{pileup}} - \text{CL}$	377 cm^{-1}	1128 cm^{-1}
$\rho_{\text{linear}} - \text{PVTEM}$	$2.7 \times 10^4\text{ cm}^{-1}$	$1.2 \times 10^5\text{ cm}^{-1}$
$\rho_{\text{overall}} - \text{PVTEM} + \text{CL}$	$1.6 \times 10^7\text{ cm}^{-2}$	$2.5 \times 10^8\text{ cm}^{-2}$
$\rho_{\text{branch}} (\text{transverse}) - \text{PVTEM}$	6000 cm^{-1} $\pm 196\text{ cm}^{-1}$	4773 cm^{-1} $\pm 693\text{ cm}^{-1}$
$\rho_{\text{branch}} (\text{axial}) - \text{PVTEM}$	939 cm^{-1} $\pm 61\text{ cm}^{-1}$	832 cm^{-1} $\pm 110\text{ cm}^{-1}$

FIG. 3

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FIG. 6A



FIG. 6B

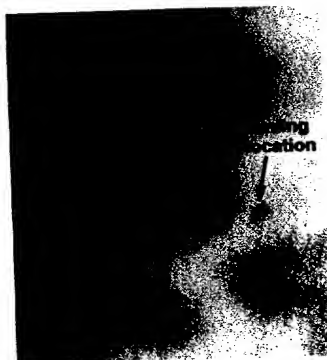


FIG. 8A



FIG. 8B

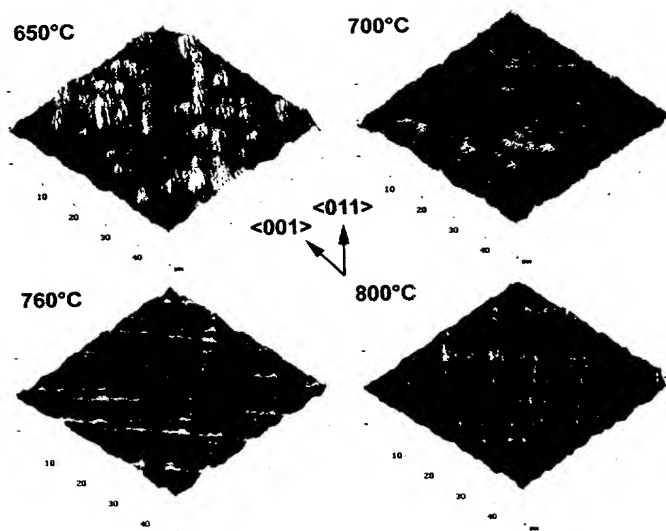


FIG. 10

20440 408200T
10023047.040402

TEMPERATURE	700°C	760°C	810°C
x	0.34	0.31	0.36
$R_q - (10\mu m)^2$	13 nm \pm 2 nm	68 nm \pm 25 nm	118 nm \pm 20 nm
$\beta_{(004)}$	275' \pm 10'	420' \pm 30'	—
$\rho_{field} - CL$	4.9 x 10 ⁶ cm ⁻² \pm 0.9 x 10 ⁸ cm ⁻²	—	—
$\rho_{field} - PVTEM$	4.4 x 10 ⁶ cm ⁻² \pm 1.0 x 10 ⁸ cm ⁻²	—	—
$\rho_{pileup} - CL$	92 cm ⁻¹ \pm 23 cm ⁻¹	> 2000 cm ⁻¹	—
$\rho_{linear} - CL + PVTEM$	2.1 x 10 ⁵ cm ⁻¹	—	—
$\rho_{overall} - CL + PVTEM$	6.8 x 10 ⁶ cm ⁻² \pm 2.0 x 10 ⁸ cm ⁻²	1.5 x 10 ⁹ cm ⁻² \pm 0.3 x 10 ⁹ cm ⁻²	—
$\rho_{branch} (transverse)$	7970 cm ⁻¹ \pm 327 cm ⁻¹	5433 cm ⁻¹ \pm 529 cm ⁻¹	—

FIG. 7

TEMPERATURE	650°C	700°C	760°C	800°C
x	0.15	0.09	0.11	0.12
$R_q - (10\mu\text{m})^2$ scan	8.5 nm \pm 1.5 nm	7.7 nm \pm 1 nm	6.0 nm \pm 0.5 nm	4.9 nm \pm 0.5 nm
$R_q - (50\mu\text{m})^2$ scan	12.2 nm \pm 1.5 nm	10.5 nm \pm 1 nm	7.4 nm \pm 0.5 nm	6.0 nm \pm 0.5 nm
β_{004}	93' \pm 5'	58' \pm 3'	54' \pm 3'	53' \pm 3'
$\rho_{\text{field}} - \text{PVTEM}$	1.2 x 10 ⁷ cm ⁻² \pm 0.3 x 10 ⁷ cm ⁻²	3.9 x 10 ⁶ cm ⁻² \pm 1.4 x 10 ⁶ cm ⁻²	1.1 x 10 ⁶ cm ⁻² \pm 0.6 x 10 ⁶ cm ⁻²	4.0 x 10 ⁵ cm ⁻² \pm 1.9 x 10 ⁵ cm ⁻²
ρ_{branch} (transverse) - PVTEM	26911 cm ⁻¹ \pm 2265 cm ⁻¹	9808 cm ⁻¹ \pm 654 cm ⁻¹	—	—
ρ_{branch} (transverse) - AFM	24114 cm ⁻¹ \pm 7312 cm ⁻¹	—	—	—
Crosshatch Wavelength <011>-A	—	—	3.4 $\mu\text{m} \pm$ 0.9 μm , 8.7 $\mu\text{m} \pm$ 0.5 μm	3.0 $\mu\text{m} \pm$ 0.3 μm , 7.0 $\mu\text{m} \pm$ 1.1 μm
Crosshatch Amplitude <011>-A	—	—	9.9 nm \pm 1.5 nm, 14.7 nm \pm 2.4 nm	7.9 nm \pm 1.2 nm, 11.7 nm \pm 1.3 nm
Crosshatch Wavelength <011>-B	—	—	4.6 $\mu\text{m} \pm$ 0.7 μm 8.5 $\mu\text{m} \pm$ 1.3 μm	3.0 $\mu\text{m} \pm$ 0.4 μm , 6.3 $\mu\text{m} \pm$ 1.5 μm
Crosshatch Amplitude <011>-B	—	—	10.5 nm \pm 2.9 nm, 17.4 nm \pm 2.7 nm	8.6 nm \pm 1.2 nm, 12.4 nm \pm 1.7 nm

FIG. 9



FIG. 11A



FIG. 11B



FIG. 13A



FIG. 13B

10023047-040402

TEMPERATURE	760°C / 700°C / 650°C
x	0.389
$R_q - (10 \mu\text{m})^2 \text{ scan}$	$13 \text{ nm} \pm 4 \text{ nm}$
$\beta_{(004)}$	$277' \pm 10'$
$\rho_{\text{field}} - \text{CL}$	$4.1 \times 10^6 \text{ cm}^{-2}$ $\pm 0.5 \times 10^6 \text{ cm}^{-2}$
$\rho_{\text{field}} - \text{PVTEM}$	$3.7 \times 10^6 \text{ cm}^{-2}$ $\pm 0.8 \times 10^6 \text{ cm}^{-2}$
$\rho_{\text{pileup}} - \text{CL}$	$71 \text{ cm}^{-1} \pm 18 \text{ cm}^{-1}$
$\rho_{\text{linear}} - \text{CL} + \text{PVTEM}$	$8.5 \times 10^3 \text{ cm}^{-1}$
$\rho_{\text{overall}} - \text{CL} + \text{PVTEM}$	$4.7 \times 10^6 \text{ cm}^{-2}$ $\pm 1.1 \times 10^6 \text{ cm}^{-2}$
$\rho_{\text{branch}} (\text{transverse}) - \text{PVTEM}$	24636 cm^{-1} $\pm 821 \text{ cm}^{-1}$
$\rho_{\text{branch}} (\text{transverse}) - \text{AFM}$	24000 cm^{-1} $\pm \text{XXX cm}^{-1}$

FIG. 12

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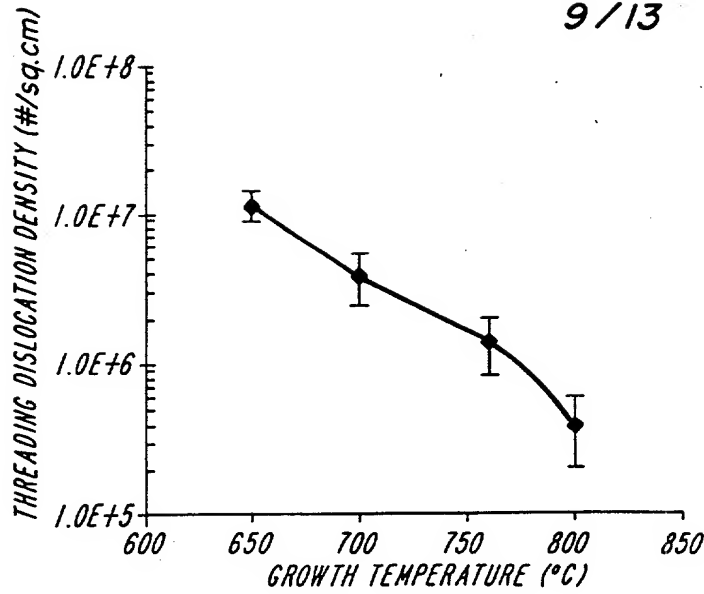


FIG. 14

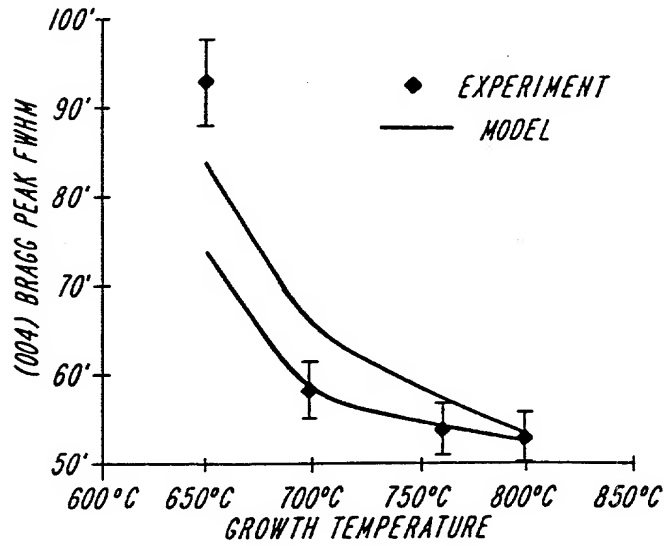


FIG. 15

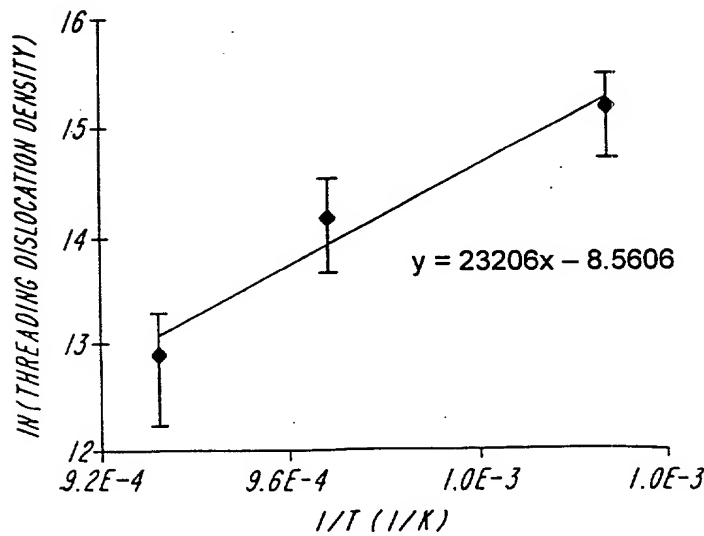


FIG. 16

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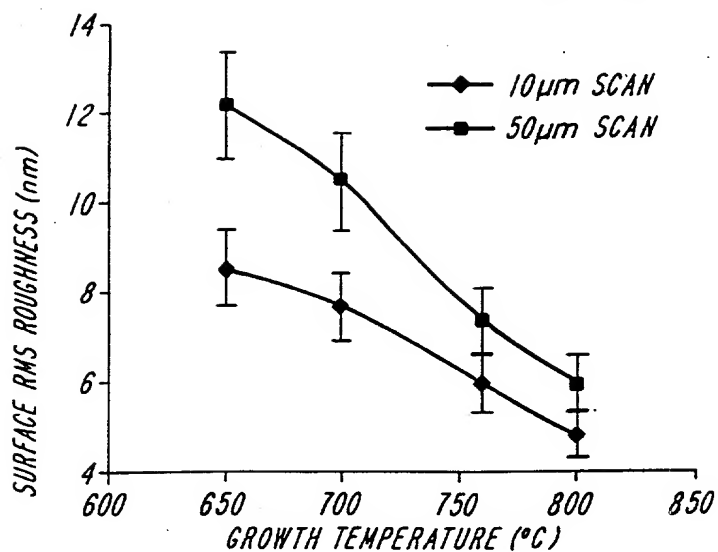


FIG. 17

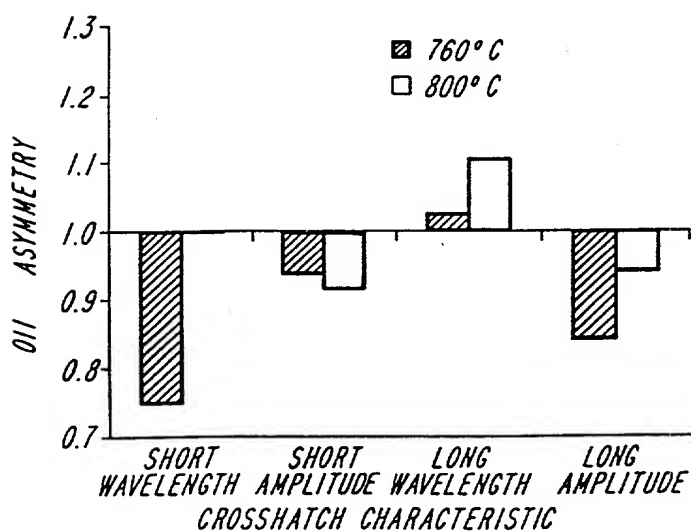


FIG. 18

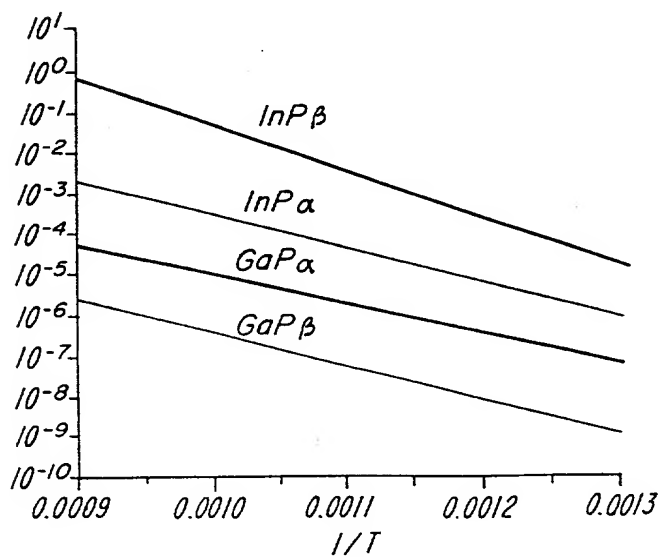


FIG. 19

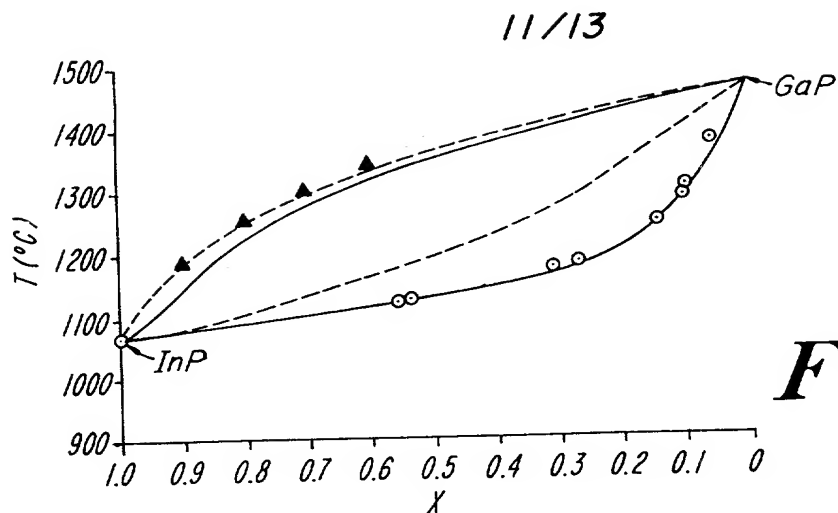


FIG. 20

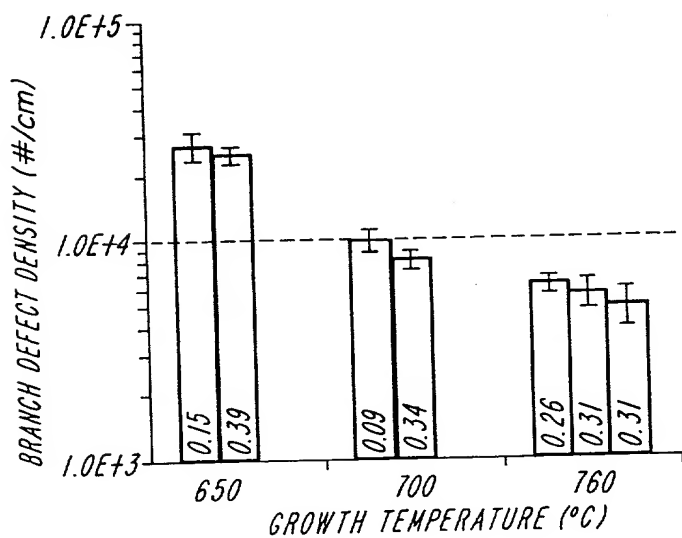


FIG. 21

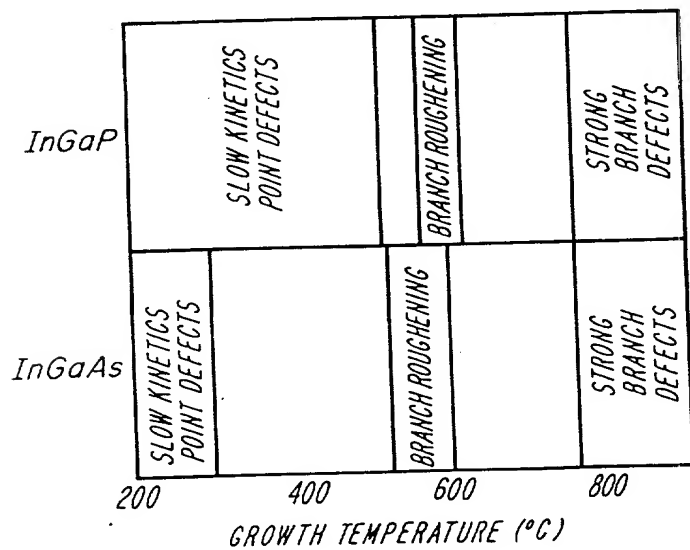


FIG. 22

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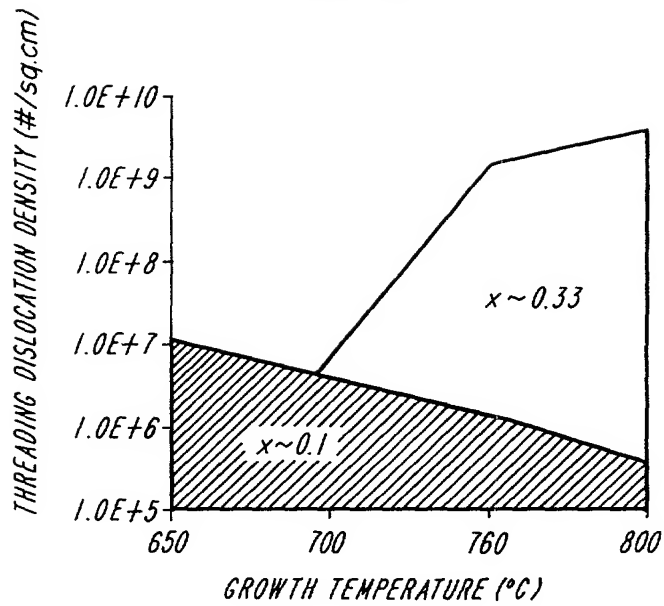


FIG. 23

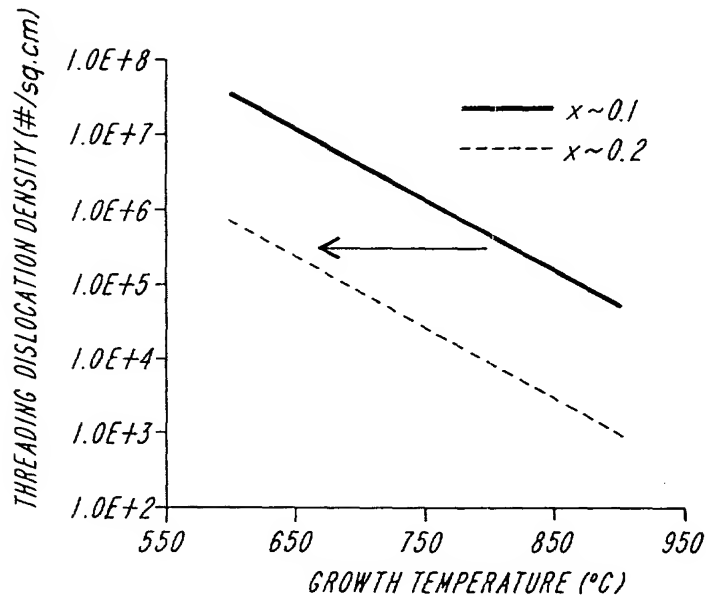


FIG. 24

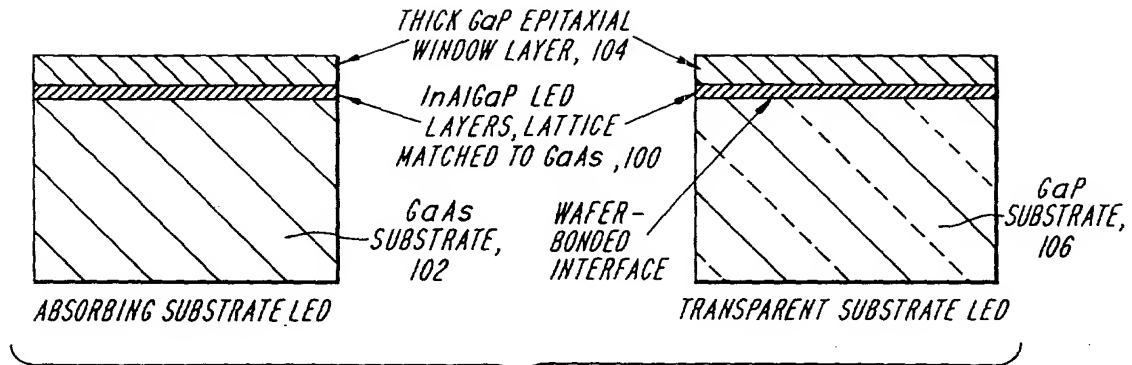


FIG. 25

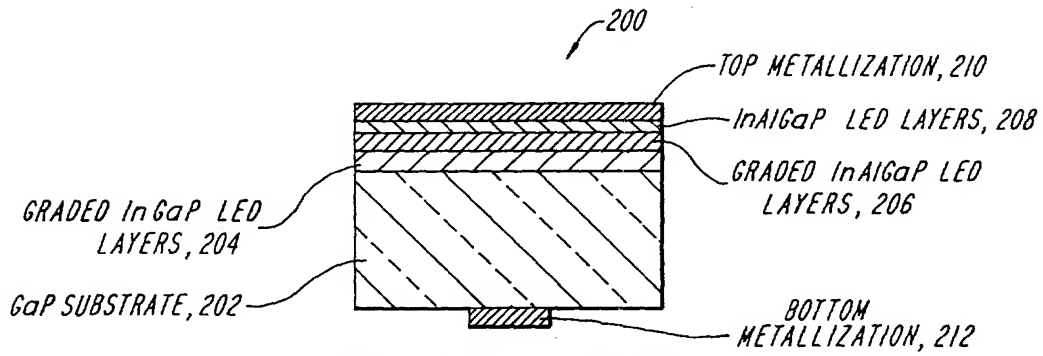


FIG. 26